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Simcenter Active Human

Enabling an accurate prediction of human body response during vehicle maneuvers

Benefits

- Accurately simulate occupant behavior in precrash emergency braking and crash avoidance maneuvers
- Facilitate rapid, nonevasive, non-destructive, low-cost iterative modeling
- Enable rapid, simultaneous simulations ideally suited for concept design of experiment studies
- Simulate more human-like behavior, especially in low-g loading conditions like precrash kinematics
- Develop user-definable parameters for strength, responsiveness, tension and alertness
- Provide omnidirectional behavior unlike dummies that are individually designed for front, side or rear impact studies

Summary

The road to automated driving, especially to level 5 – full automation – requires substantial research. One of these topics is the accepted seating positions, which are related to pre-crash human kinematics to determine initial crash conditions. Moreover, safety systems are becoming more individualized and attempts are being made to account for the effects of occupant size/body mass index (BMI), gender and age on the optimal performance of occupant safety systems.

Simcenter™ Active Human software, part of the validated and biofidelic set of Simcenter Madymo™ software human models, is used to predict passive, active and reactive responses before and during vehicle crashes. Simcenter Active Human can be used to predict human response for a broad range of loading conditions for which no physical crash test dummy exists and is validated for frontal, lateral, rear, oblique and vertical loading conditions.

Simcenter Active Human combines passive stiffness characteristics and active control, including muscle reflex

behavior and joint restraints, to realistically represent responses of human beings. This makes it the only active human model of this kind that can be used to accurately simulate occupant behavior in pre-crash emergency braking and crash avoidance maneuvers, making it easier and faster to provide results, thus facilitating rapid, non-evasive, nondestructive, low-cost iterative modeling. *A three-second event simulated on a standard hardware configuration will take approximately two hours to complete.*

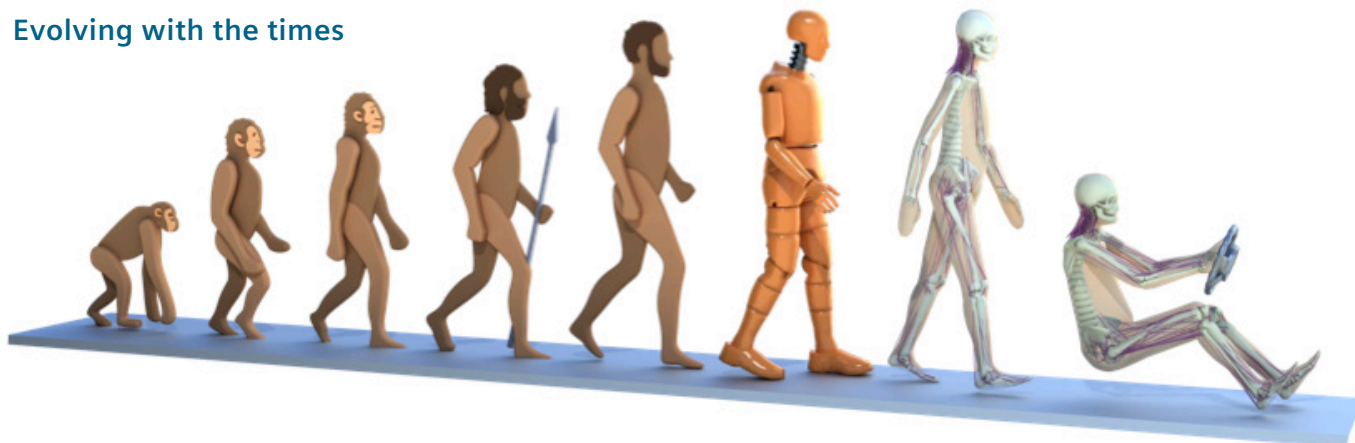
Design

The Simcenter Madymo 50th percentile male human body model has been designed to represent an average human with conditions that are aligned for automotive safety:

- Active shoulder control enhancements allow for lane change studies, as Simcenter Active Human resists lateral motion in a more human-like behavior by holding the steering wheel at scalable strength levels. With enhanced strength scaling, the user can assign varying levels of occupant strength to better reflect the ranges in human resistance to motion
- Unconsciousness modeling enables users to simulate the behavior of an occupant who is drowsy, asleep or unconscious. This functionality greatly assists the development of autonomous vehicles in which the occupant is no longer in control and the car is at level 5 of automation (fully autonomous)

Simcenter Active Human

Evolving with the times



- Controlled head position using neck muscles and balanced muscle recruitment (co-contraction)
- Controlled elbow position using arm muscles
- Controlled spine position using actuators
- Controlled hip position using leg muscles
- Available in pedestrian (standing) and occupant (seated) positions

Features

Simcenter Active Human enables you to:

1. Simulate pedestrian and occupant impacts.
2. Simulate passive, active and reactive (stabilizing) behavior automatically:
 - Reactive: The human moves to a user-defined position or stabilizes its initial position
 - Passive: No stabilization occurs and the human behaves as a postmortem human subject (PMHS)

User parameters are offered to represent occupant awareness and relaxation states:

- Muscle activation – reflects PMHS and weaker and stronger individuals. Available for neck, arms, legs, hip and spine separately to represent disabled individuals

- Muscle reaction time – represents awareness
- Muscle co-contraction – simultaneous tension of all muscles without giving resultant torque to represent bracing

Low-g pre-crash braking

Simcenter Active Human is validated for several low gravitational (g) frontal pre-crash braking scenarios. Simulation results accurately follow the measured neck and chest displacements, which are much larger and more variable for humans when compared to crash test dummy responses.

Medium and high-g impacts

The passive response of the model to medium- and high-g impact events has been extensively validated against PMHS data. The results of these tests along with their simulation counterparts are available in the active human model quality report to give full insight into the validation level.

Predicting and evaluating human response in crash simulation

The Simcenter Madymo software suite offers full flexibility and generates fast and accurate responses. Simcenter Madymo is an efficient multi-physics solver combining multi-body (MB),

finite element (FE) and computational fluid dynamics (CFD) technologies. It provides vehicle safety engineers with rapid, extensive functionality and a modular, user-friendly setup of the (XML formatted) input deck. Sub-models can easily be exchanged making it faster and easier to explore a variety of safety concepts.

Siemens Digital Industries Software's 30-year proven track record in automotive safety allows us to offer a powerful and extensive dummy model database consisting of excellent validation levels. Simcenter Madymo is a terrific computer-aided engineering (CAE) tool for today's vehicle safety engineer.

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